PROC. ENTOMOL. SOC. WASH.
94(3), 1992, pp. 309–313

LIFE HISTORY OF *EPIMECHUS CANOIDES* FALL (COLEOPTERA: CURCULIONIDAE) ON SEEPWILLOW, *BACCHARIS SALICIFOLIA* (R.&P.) PERS. (ASTERACEAE)

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Abstract.—The weevil *Epimechus canoides* fed on leaves or flowerheads of seepwillow, *Baccharis salicifolia,* in New Mexico, Texas and northern Mexico. There was one generation per year. In no-choice tests, adults fed on leaves of *B. neglecta* and *B. halimifolia.* Weevils oviposited in swollen or slightly opened flowerhead buds, from July to September. Adults and immatures were more numerous in female than in male flowerheads and in plants nearer the water than in dry soil. In 1985, infestations were 20 to 27% greater in female than male flowerheads; in 1986, they were 13 to 22% greater. One egg was deposited per flowerhead and larvae fed to pupation on the receptacle and developing achenes. Up to 66% of the female and 41% of the male flowerheads were infested. There were three larval instars. Pupation occurred in the flowerhead.

Key Words: Coleoptera biology, Curculionidae, *Epimechus, Baccharis salicifolia,* seepwillow, Texas

The genus *Epimechus* Dietz (Coleoptera: Curculionidae: Anthonomini) contains 14 species of small, brown to off-white colored weevils which occur in the western United States (O'Brien and Wibmer 1982). Three little-known species occur in the Southwest on unisexual composite plants of the genus *Baccharis. Epimechus canoides* Fall and *E. arenicolor* Fall occur east and west of the Continental Divide, respectively (Boldt and Robbins 1990). Adult weevils feed on leaves and flowers of seepwillow, *Baccharis salicifolia* (R.&P.) (= *glutinosa* Pers.) (Asteraceae) and larvae feed in the flowerheads. Descriptions of larvae and pupae are given for *E. arenicolor* but not for *E. canoides* (Ahmad and Burke 1972, Burke 1968). Larvae of *Epimechus curvipes* Dietz feed in galls on *B. bigelovii* Gray and *B. pteronioides* DC. in Arizona, New Mexico, and Mexico (Boldt and Robbins, unpublished manuscript).

Epimechus is considered to be closely related to *Anthonomus* Germar but differs from it by the presence of simple tarsal claws (Fall 1901). Claw appendiculation, however, is variable between species and is not a reliable generic characteristic. Lack of identifiable characters led Fall (1901), Burke (1968), and Ahmad and Burke (1972) to express doubt as to the validity of *Epimechus* as a distinct genus.

Seepwillow, *Baccharis salicifolia,* is a problem weed in streams and rivers of the southwestern United States and southern South America. Thickets of unisexual, woody shrubs, 3 to 4 m in height, sometimes block waterways, causing stream banks to fail. The plant has no value as forage for animals (Gatewood et al. 1950, Fletcher and Elmendorf 1955, Boldt 1989). Leaves are narrow, elongate, and glutinous. Each plant produces tens of thousands of

[1] Contribution from the U.S. Department of Agriculture, Agricultural Research Service, USDA-ARS, 808 East Blackland Road, Temple, TX 76502.

whitish male or female flowerheads in flat-topped clusters of 25 to 150 flowerheads per cluster. A single female flowerhead contains 10 to 20 florets and a male contains about 50 florets. In Texas, flowering occurs from July to October (Correll and Johnston 1979).

We studied the life history of *E. canoides* in the Chihuahuan desert of west Texas as part of a long-term study of the native, phytophagous insects of *Baccharis* (Boldt and Robbins 1987, 1990, Boldt et al. 1988).

Materials and Methods

Field studies.—Observations of *E. canoides* were made periodically from 1985 to 1988 at two stream sites, Cibolo Creek, Shafter (Presidio Co.), and Musquiz Creek, Fort Davis (Jeff Davis Co.), Texas. Each site consisted of ca. 1 ha of more than 500 seepwillow plants growing along the banks of the stream or in the water, partially restricting its flow. The number of weevil larvae, pupae, and adults was assessed monthly from March to October in 1985 and from July to October in 1986 by sweeping 25 male and 25 female plants. In addition, 100 flowerheads from male and female plants located in an open area in Cibolo Creek and 7 to 10 m from the creek, and in partial shade 12 to 25 m from the creek, were sampled without bias on September 4, 1985. Flowerheads were dissected and the number of infested male and female flowerheads from each sample was recorded. Means were analyzed with the analysis of variance and Duncan's multiple range tests (MSTAT 1985).

Laboratory studies.—Experiments and observations were conducted at room temperature of 22° to 26°C, relative humidity of 40 to 60%, and a 14:10 h L:D photoperiod under fluorescent light. Egg size was determined by measuring live, 0 to 48 h-old eggs dissected from flowerheads. The number of larval instars was determined by measuring head capsule widths of 54 larvae collected in August, 1984, at Cibolo Creek and preserved in 70% ethanol. Measurements were made with a calibrated ocular micrometer in a stereomicroscope. No-choice adult feeding tests were conducted by holding an adult in a petri dish on freshly excised leaves of selected plants. Ten weevils were tested on each plant species. Leaves were replaced three times weekly and the amount of damage was determined by counting puncture marks in the leaf. Plants used were collected in western Texas and held outdoors in pots.

Insect voucher specimens have been deposited in the National Museum of Natural History, Washington, D.C., and the Insect Collection of the Department of Entomology, Texas A&M University, College Station.

Results and Discussion

Specimens of *E. canoides* were collected on seepwillow at the following locations: Marfa, Fort Leaton, Shafter (Presidio Co.), Alpine (Brewster Co.), and Fort Davis, Texas; Kingston (Sierra Co.), New Mexico; and Jimenez and Chihuahua City (Chihuahua State) Mexico. Fall (1913) originally described *E. canoides* from four specimens collected at El Paso (El Paso Co.), Texas. We made an extensive search of seepwillow and four other species of *Baccharis* in the southwestern United States, but found *E. canoides* only on seepwillow east of the Continental Divide (Boldt and Robbins 1990, Boldt unpublished data). Larvae of *E. canoides* were identified by rearing them to adults since they could not be distinguished from larvae of *E. arenicolor*. Scales on the elytral disc were denser and the male aedeagus was broader in *E. canoides* than in *E. arenicolor* adults.

Adult stage.—Length of the adult weevil was 2.10 to 2.22 mm ($n = 10$, $\bar{x} = 2.12 \pm 0.09$ mm). This range overlapped the 2.00 to 2.15 mm given by Fall (1913). Teneral adults were golden-brown in color in October, but lightened with age and became grayish-white by the following spring. Adult feeding punctures were small, round to oblong circles, 0.01 to 0.03 mm in diameter

Table 1. Number of adult *E. canoides* on each seepwillow and percent of plants infestated in Cibolo Creek, 1986.

Date	Plants			
	Female		Male	
	No. of Adults per Plant[a]	% Infestation of Flowers[b]	No. of Adults per Plant[a]	% Infestation of Flowers[b]
10 July	21.6	47.2 ± 8.3	—	—
14 August	7.6	53.5 ± 15.6	6.1	35.5 ± 13.4
18 September	13.4	45.5 ± 14.2	16.1	23.0 ± 14.8
15 October	7.4	31.0 ± 16.8	5.6	18.0 ± 7.4

[a] Mean number of adults per 25 plants swept.
[b] Mean ± SD of 4 replications of 25 flowerheads per date.

and up to 0.5 mm deep into leaf tissue. Feeding was about equally divided between upper (55.9%) and lower (44.1%) sides of leaves but 1044 (86.0%) of 1215 observed punctures occurred along the margins of the leaf as opposed to in the center. Adults fed on leaves or small stems until July when they also began to feed on the flowerheads.

In no-choice tests, adults fed and survived for one week on leaves of seepwillow, *Baccharis neglecta* Britt., and *B. halimifolia* L. but died within three to five days with little or no feeding on *B. pilularis* DC., *B. brachyphylla* Gray, *B. pteronioides* DC., *Gutierrezia sarothrae* (Pursh) Shinners, *Gymnosperma glutinosum* (Spreng.) and *Isocoma wrightii* (T.&G.) Greene (Asteraceae).

There was one generation per year. Oviposition occurred from July to October in swollen or slightly opened male and female flowerhead buds. Many of the 540 adults sampled in July 1986 were mating or ovipositing but those sampled in September and October were teneral, indicating a new generation. To oviposit, the female chewed a hole through a phyllary into the pappus, inserted an egg, and closed it with a plug. This plug was composed of fecal material mixed with a clear sticky liquid which, on drying, became brown in color. Usually, one egg was laid per flowerhead. Of 1200 infested flowerheads dissected in 1986, only one contained a second immature weevil. Eggs of *Trioza collaris* Crawford (Homoptera: Psyllidae) and *Lioptilodes parvus* (Walsingham) (Lepidoptera: Pterophoridae) also were commonly present in seepwillow flowerheads, and their immature stages sometimes competed with larvae of *E. canoides.*

Female weevils oviposited more in female than in male flowerheads as indicated by a higher infestation rate. In 1985, infestations of female flowerheads were 20 to 27% greater than in male flowerheads, and in 1986 they were 13 to 22% greater (Tables 1 and 2). Weevils also were found to feed and oviposit more on plants growing in wet soil near the water than on plants growing in dry soil (df = 2,12; $P = 0.05$) (Table 2). For male flowerheads, differences in the percentage of infestations between open and shaded areas in dry soil were nonsignificant.

Teneral adults emerged from seepwillow flowerheads between August and October and fed for one to three months before en-

Table 2. Percentage of seepwillow flowerheads infestated by immature *E. canoides,* 1985.

Flowerheads	Sample Sites[a]		
	Partial Shade, Dry Soil	Open Area, Dry Soil	Open Area, Wet Soil
Female	28.0[c] ± 6.6	42.0[b] ± 1.7	66.3[a] ± 5.9
Male	18.3[d] ± 4.0	15.7[d] ± 5.7	41.0[b] ± 4.6

[a] Means (±SD) of 3 replications of 100 male and female flowerheads per site.
Means followed by the same letter are not significantly different ($P = 0.05$).

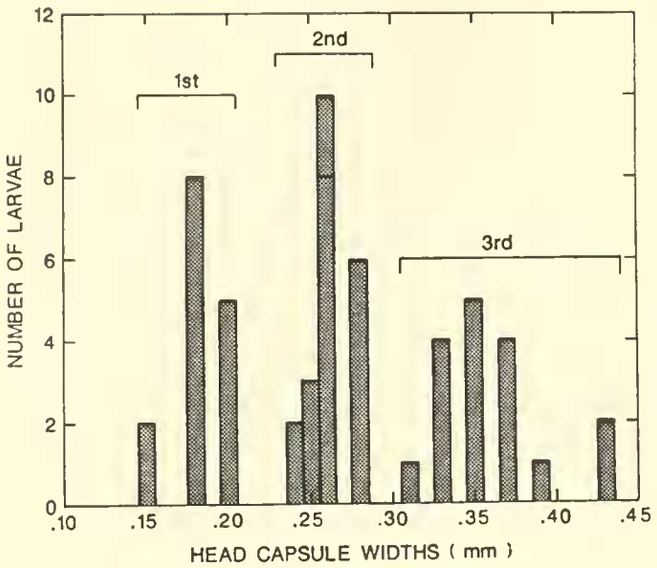

Fig. 1. Frequency distribution of head capsule widths (mm) of first, second, and third instar larvae of *Epimechus canoides,* Presidio County, Texas.

tering diapause and overwintering in ground debris. Their reappearance the following April coincided with production of new leaves on the plant.

Immature stages.—Eggs of *E. canoides* were smooth and white to pale yellow in color, darkening slightly with age. Mean lengths and widths (± standard deviation) of 21 eggs were 0.43 ± 0.02 and 0.30 ± 0.02 mm, respectively. There were three larval instars (Fig. 1). Mean head capsule widths were 0.18 ± 0.01 (n = 15), 0.23 ± 0.01 (n = 13), and 0.35 ± 0.02 (n = 15) mm for the first, second, and third larval instar, respectively. Larvae destroyed most of the achenes and pappus and much of the receptacle of the flowerhead. As larvae neared maturity, they glued the uneaten pappus hairs together with saliva and fecula to form a cell and pupated in the flowerhead. Mean length of the pupa was 2.21 ± 0.24 mm (n = 15). Adult emergence occurred through the side of the flowerhead just above the involucre.

Natural enemies.—The following hymenopteran parasites, reported in part by Boldt and Robbins (1990), were occasionally reared from larvae or pupae of *E. canoides: Zatropis* sp., *Catolaccus* sp. (Pteromalidae), *Tetrastichus* sp., and *Aprostocetus* sp. (Eulophidae). The hyperparasite *Horismenus* sp. (Eulophidae) was also reared.

Acknowledgments

We thank Michael Young and Norman Erskine, Grassland, Soil and Water Research Laboratory, USDA-ARS, Temple, Texas, for technical assistance and H. R. Burke (Texas A&M University, College Station) and M. E. Schauff (Systematic Entomology Laboratory, USDA, Agricultural Research Service, Beltsville, Maryland) for identification of the insects mentioned in this report.

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